For the reasons set forth in the preamble, title 40 chapter I of the Code of Federal Regulations is proposed to be amended as follows:

PART 9 - [AMENDED]

1. The authority citation for part 9 is proposed to continue to read as follows:

[Insert Authority Citation]

2. In §9.1 the table is proposed to be amended by adding under the indicated heading the new entries in numerical order to read as follows:

§9.1 OMB Approvals under the Paperwork Reduction Act

* * * * *

40 CFR citation	OMB control no.
* * * * *	
National Primary Drinking Water Regulations	
* * * * *	
141.1100 - 141.1171	
* * * * *	
142.14 - 142.16	
* * * * *	

* * * * *

PART 141 - NATIONAL PRIMARY DRINKING WATER REGULATIONS

3. The authority citation for Part 141 continues to read as follows:

Authority: 42 U.S.C. 300f, 300g-1, 300g-2, 300g-3, 300g-4, 300g-5, 300g-6, 300j-4, 300j-9, and 300j-11.

4. Section 141.2 is proposed to be amended by adding, in alphabetical order, definitions for bag filters, bank filtration, cartridge filters, membranes, and plant intake.

§141.2 Definitions.

* * * * *

Bag filters are pressure-driven separation devices that remove particulate matter larger than 1 μm using an engineered porous filtration media through either surface or depth filtration. Bag filters are typically constructed of a non-rigid, fabric filtration media housed in a pressure vessel in which the direction of flow is from the inside of the bag to outside.

* * * * *

Bank filtration is a water treatment process that makes use of surface water that has naturally infiltrated into ground water via the river bed or bank(s) and is recovered via a pumping well. Infiltration is typically enhanced by the hydraulic gradient imposed by a nearby pumping water supply or other well(s).

* * * * *

Cartridge filters are pressure-driven separation devices that remove particulate matter larger than 1 μm using an engineered porous filtration media through either surface or depth filtration. Cartridge filters are typically constructed as rigid or semi-rigid, self-supporting filter elements housed in pressure vessels in which flow is from the outside of the cartridge to the inside.

* * * * *

Membrane is a pressure-driven or vacuum-driven separation device in which particulate matter larger than 1 μm is rejected by an engineered barrier primarily through a size exclusion mechanism, and which has a measurable removal efficiency of a target organism that can be verified through the application of a direct integrity test. This definition includes the common membrane technologies of microfiltration (MF), ultrafiltration (UF), nanofiltration (NF), and reverse osmosis (RO). Devices that remove particulate matter through mechanisms other than size exclusion, such as straining by chance contact, sedimentation, interception, or adhesion, are not considered membrane processes.

* * * * *

Plant intake refers to the works or structures at the head of a conduit through which water is diverted from a source (e.g.,

river or lake) into the treatment plant.

5. Subpart H is proposed to be amended by amending §141.71(b)(6) to read as follows:

§141.71 Criteria for avoiding filtration.

* * * * *

(b) * * *

* * * * *

(6) * * * After the dates identified in §141.1002, the system must comply with the requirements for TTHM and HAA5 in subpart XXX.

6. Section 141.153 is proposed to be amended to read as follows:

§141.153 Content of the reports.

[TBD]

7. Subpart Q is proposed to be amended to read as follows:

Subpart Q-- Public notification of Drinking Water Violations.

[Add LT2 to public notice tiering table (all TT violations are tier 2) in Appendix A to Subpart O for *Cryptosporidium* treatment technique violations (Add I.A.8. LT2ESWTR TT violations).]

8. Part 141 is proposed to be amended by adding a new subpart Ω to read as follows:

Subpart Ω - Enhanced Filtration and Disinfection for *Cryptosporidium*

[Table of contents will need to be updated to reflect new organization of subpart.]

General Requirements

141.1100 Who is subject to the requirements of subpart Ω?

141.1101 What are the general requirements of this subpart?

Appendices to subpart Ω

Appendix A - UV approval

Appendix B - Membrane approval

Appendix C - Bag and cartridge filter approval

Appendix D - Bank filtration approval

General Requirements

§141.1100 Who is subject to the requirements of subpart Ω?

The requirements of this subpart apply to all subpart H systems (public water systems that use surface water or ground water under the direct influence of surface water). Failure to comply is a violation and requires public notification.

§141.1101 What are the general requirements of this subpart?

You must comply with the requirements in this subpart on the schedule in paragraph (d) and in the Compliance Requirements Table in paragraph (e). You must characterize your source water to determine what (if any) additional treatment is necessary for *Cryptosporidium*, unless you meet the criteria in either paragraphs (f) or (g). If additional treatment is necessary, you must provide the additional required treatment by using one of the tools identified in §141.1122.

(a) If you are a subpart H system serving at least 10,000 people that currently provides filtration or that is unfiltered and required to install filtration because you no longer meet all filtration avoidance criteria, you must conduct initial source water monitoring that includes *Cryptosporidium, E. coli* and turbidity sampling.

(b) If you are a subpart H system serving fewer than 10,000 people that currently provides filtration or that is unfiltered and required to install filtration because you no longer meet all filtration avoidance criteria, you must conduct initial source water monitoring consisting of *E. coli* sampling. You will have additional monitoring and treatment technique requirements for *Cryptosporidium* under this subpart only if your results show an annual mean *E. coli* concentration that exceeds 10/100 ml for lake and reservoir sources or 50/100 ml for flowing stream sources. If you exceed these levels, then you must conduct *Cryptosporidium* monitoring to complete your initial monitoring and your treatment technique requirements will be based on these *Cryptosporidium* results.

(c) If you are a subpart H system that does not currently provide filtration and meets all filtration avoidance criteria, you

must conduct initial source water monitoring consisting of *Cryptosporidium* sampling.

(d) You must comply with the uncovered finished water reservoir requirements in §141.1124 no later than [INSERT DATE 36 MONTHS FOLLOWING PUBLICATION].

(e) You must comply with the requirements in this subpart based on the schedule in the table in this paragraph, except that you are not required to conduct initial source water monitoring if you meet the criteria in either paragraphs (e) or (f).

Compliance Requirements Table

If you are a...	Then you must perform...(5)(8)	And comply by...
Subpart H system that serves ≥10,000 people	(a) 24 months of source water monitoring (1) beginning [insert month 6 months after publication] (9)	Submitting a monthly report to the State NLT the end of the second month after the month that the sample is taken
	(b) Treatment Technique installation, if necessary	Installing treatment and complying with the treatment technique no later than [72 months after publication]
Subpart H system serving <10,000 people that currently provides filtration and is not required to monitor for *Cryptosporidium* based on *E. coli* monitoring results(6)	(a) 12 months of *E. coli* source water monitoring (3) beginning [insert month 30 months after publication] (9)	Submitting a monthly report to the State NLT the end of the second month after the month that the sample is taken
Subpart H system serving <10,000 people that currently provides filtration and must perform *Cryptosporidium* monitoring based on *E. coli* monitoring results(6)	(a) 12 months of *E.coli* source water monitoring (3) beginning [insert month 30 months after publication] and 12 months of *Cryptosporidium* monitoring beginning [insert month 48 months after publication] (2) (9)	Submitting a monthly report to the State NLT the end of the second month after the month that the sample is taken
	(b) Treatment Technique installation, if necessary	Installing treatment and complying with the treatment technique no later than [102 months after publication]
Subpart H system serving <10,000 people that currently does not provide filtration	(a) 24 months of source water monitoring (2) beginning [insert month 48 months after publication] (9)	Submitting a monthly report to the State NLT the end of the second month after the month that the sample is taken
	(b) Treatment Technique installation	Installing treatment and complying with the treatment technique no later than [90 months after publication]

[1] Consists of source water *Cryptosporidium, E. coli*, and turbidity sampling conducted at least monthly
[2] Consists of source water *Cryptosporidium* sampling conducted at least twice/month.
[3] Consists of source water *E. coli* sampling every two weeks.
[4] [Reserved]
[5] Any sampling performed more frequently than required must be evenly distributed over sampling period
[6] If 12 months of *E. coli* monitoring demonstrate a mean >10/100ml for a lake or reservoir source or >50/100ml for a flowing stream source, you must monitor for *Cryptosporidium.*
[7] [Reserved]
[8] You may use data that meets the requirements in §141.1107 collected prior to the monitoring start date to substitute for an equivalent number of months at the end of the monitoring period. Data collected must be equivalent.
[9] Source water monitoring must be repeated no later than six years following this date.

(f) In lieu of initial source water monitoring under paragraph (e), you may submit data collected previously. You may also use

data collected prior to the monitoring start date to substitute for an equivalent number of months at the end of the monitoring period. The data must meet the requirements in §141.1106.

(g) You are not required to conduct initial source water monitoring if you provide a total of at least 5.5 log of treatment for *Cryptosporidium*, equivalent to meeting the treament requirements of Bin 4 in §141.1120.

§141.1102 When do I have to conduct initial source water monitoring?

(a) If you serve at least 10,000 people or you are a wholesale system that must conduct an IDSE due no later than [insert date 24 months after publication] under subpart XXX, you must submit your initial source water monitoring plan to EPA [insert address] and your State no later than [insert date three months after publication]. If you serve fewer than 10,000 people and you are not required to conduct an IDSE due no later than [insert date 24 months after publication] under subpart XXX, you must submit your monitoring plan to your State no later than [insert date 27 months after publication]. Your monitoring plan must include the sampling location(s), frequency of sampling, and the calendar dates that all samples will be taken.

(b) You must conduct initial source water monitoring under the schedule in §141.1101.

(c) You must take samples within two days of the dates indicated in your sampling plan.

(d) If extreme conditions or situations exist that may pose danger to the sampler or which are unforeseen or cannot be avoided, and which cause you to be unable to sample in the required time frame, you must submit an explanation to EPA or the State to justify the alternative sampling date.

(e) You must submit your monitoring results to EPA electronically to [insert Internet address] if you serve at least 10,000 people or to the State if you serve fewer than 10,000 people not later than the end of the second month following the month that the sample was collected. Your submission must include the applicable information in paragraphs (e)(1) through (e)(6). If you do not have the ability to submit data electronically, you may use an alternative format approved by EPA or the State.

(1) You must report the data elements in this paragraph for each *Cryptosporidium* sample.

Reportable *Cryptosporidium* data elements

Sample number
Plant ID
Data element
Identifying Information
PWSID
Sample collection date
Laboratory ID
Sample type (field or MS)
Primary Measurements
Turbidity
Sample volume spiked, to nearest ¼ L (MS only)
Sample volume filtered, to nearest ¼ L
Estimated number of oocysts spiked (MS only)
Volume of resuspended concentrate
Volume of resuspended concentrate transferred to IMS
Number of oocysts under FA
Holding Time Information
Sample collection time
Elution completion date
Elution completion time
Slide preparation completion time
Slide preparation completion date
Staining completion date
Staining completion time
Examination/confirmation completion date
Examination/confirmation completion time
Quality Control Information
Quality control batch ID
Positive staining control acceptable?
Negative staining control acceptable?
Were the results of the associated OPR sample acceptable?
Were the results of the associated method blank acceptable?
Additional Information
Comments
Calculated Values
Sample volume analyzed
Sample concentration (oocysts/L)
Percent recovery
Flags

(2) You must report the data elements in this paragraph for each *E. coli* analysis.

Common reportable data elements for *E. coli* analyses

Data element
Identifying Information
Public Water System ID Number
Public water system facility ID number/ Sampling point ID number/ Sampling point type identification
Sample collection date
Sample identification number
Contaminant/parameter
Analytical method number
Media
Source water type
Quality Control Information
Sample collection time
Arrival temperature
Deviations from quality control requirements
Calculated Values
Analytical result - value
Analytical result - unit of measure
Turbidity Information
Turbidity method number
Turbidity result - value
Turbidity result - unit of measure

(3) In addition to the requirements in paragraph (e)(2), you must report the data elements in this paragraph for each *E. coli* analysis by membrane filtration.

Reportable data elements *E. coli* analyses by membrane filtration

Data element
Primary Measurements
Filter 1
mL of sample filtered
Number of *E. coli* colony forming units (CFU)
Filter 2
mL of sample filtered
Number of *E. coli* colony forming units (CFU)
Filter 3
mL of sample filtered
Number of *E. coli* colony forming units (CFU)
Filter 4
mL of sample filtered
Number of *E. coli* colony forming units (CFU)
Holding Time / Incubation Time Information

Incubation start date
Incubation start time
Filter transfer date (if applicable)
Filter transfer time (if applicable)
Membrane filtration read date
Membrane filtration read time

(4) In addition to the requirements in paragraph (e)(2), you must report the data elements in this paragraph for each *E. coli* analysis by 97-Well ONPG-MUG and CPRG-MUG methods

Reportable data elements for *E. coli* analyses by 97-Well ONPG-MUG and CPRG-MUG methods

Data element
Primary Measurements
mL of sample added to tray
Large wells positive: Total coliform positive and UV fluorescence
Small wells positive: Total coliform positive and UV fluorescence
Holding Time / Incubation Time Information
Start date
Start time
Read date
Read time

(5) In addition to the requirements in paragraph (e)(2), you must report the data elements in this paragraph for each *E. coli* analysis by 51-Well ONPG-MUG and CPRG-MUG methods.

Reportable data elements for *E. coli* analyses by 51-Well ONPG-MUG and CPRG-MUG methods

Data element
Primary Measurements
mL of sample added to tray
Number of wells positive: Total coliform positive and UV fluorescence
Holding Time / Incubation Time Information
Start date
Start time
Read date
Read time

(6) In addition to the requirements in paragraph (e)(2), you must report the data elements in this paragraph for each *E. coli* analysis by 15-Tube MPN ONPG-MUG and CPRG-MUG methods.

Reportable data elements for *E. coli* analyses by 15-Tube MPN ONPG-MUG and CPRG-MUG methods

Data element
Primary Measurements
Number of positive 10.0 mL tubes: Total coliform positive and UV fluorescence
Number of positive 1.0 mL tubes: Total coliform positive and UV fluorescence
Number of positive 0.1 mL tubes: Total coliform positive and UV fluorescence
Number of positive 0.01 mL tubes: Total coliform positive and UV fluorescence
Number of positive 0.001 mL tubes: Total coliform positive and UV fluorescence
Number of positive 0.0001 mL tubes: Total coliform positive and UV fluorescence
Holding Time / Incubation Time Information
Start date
Start time
Read date
Read time

(7) In addition to the requirements in paragraph (e)(2), you must report the data elements in this paragraph for each *E. coli* analysis by 15-Tube MPN fermentation methods.

Reportable data elements for *E. coli* analyses by 15-Tube MPN fermentation methods

Data element
Primary Measurements
Number of positive tubes 10.0 mL
Number of positive tubes 1.0 mL
Number of positive tubes 0.1 mL
Number of positive tubes 0.01 mL
Number of positive tubes 0.001 mL
Number of positive tubes 0.0001 mL
Holding Time / Incubation Time Information
LTB Start date (for each tube)
LTB Start time (for each tube)
Transfer from LTB to EC-MUG date (for each tube)
Transfer from LTB to EC-MUG time (for each tube)
EC-MUG Read date (for each tube)
EC-MUG Read time (for each tube)

(f) If you fail to report a valid *Cryptosporidium* analytical result for a prescribed sampling date or if you do not receive approval under paragraph (d) for the alternative sampling date, you must monitor on an alternative date approved by EPA or

the State.

(g) You must repeat each of the requirements of this section no later than six years after the dates specified in this section and in §141.1101, except that you will submit plans and data only to the State.

§141.1103 Where do I take my source water samples?

(a) Unless specified otherwise in this section, you must take source water samples at a location prior to any treatment and where the water is no longer subject to surface runoff. Where treatment is applied in an intake pipe such that sampling in the pipe is not feasible, you must sample as close to the pipe as is feasible, at a similar depth and distance from shore.

(b) Systems using existing bank filtration in addition to other filtration. You must take source water samples after bank filtration, but before any other treatment. You may not receive credit for bank filtration under §141.1125.

(c) Systems using an existing presedimentation basin. You must take source water samples either before or after an existing presedimentation basin. If you take samples after the existing presedimentation basin, you may not receive credit for the presedimentation basin under §141.1125.

(d) Systems using existing off-stream storage. You must take source water samples either before or after existing off-stream storage. If you take samples after the existing off-stream storage, you may not receive credit for the off-stream storage under §141.1125.

(e) Systems using ground water under the direct influence of surface water without other filtration. You must take source water samples in the surface water if you are using an alternative filtration credit under subpart P or subpart T to meet *Cryptosporidium* removal requirements.

(f) You must include these sampling locations in the monitoring plan submitted under §141.1102(a).

§141.1104 What analytical methods does my system have to use?

(a) *Cryptosporidium.* Methods 1622/23 *"Cryptosporidium* and *Giardia* in Water by Filtration/IMS/FA", EPA 821-R-99-001, January 1999 for analysis and EPA-821-R-99-006, April 1999 for monitoring. [REPLACE WITH CFR CITE WHEN FINALIZED.]

(1) You are required to analyze at least a 10-liter sample or a packed pellet volume of at least two mL as generated by the

methods listed in paragraph (a). If you are unable to process a 10-liter sample, you must analyze as much sample volume as can be filtered by two filters, up to a packed pellet volume of two mL.

(2) You may collect and analyze a sample volume greater than 10 liters if you collect and analyze this larger sample volume throughout the entire monitoring period.

(3) Matrix spikes as required by Methods 1622 and 1623 must be processed in the laboratory. The sample volume of the matrix spike must equal the volume of the unspiked sample and the samples must be collected by splitting the sample stream or if collecting bulk samples by splitting the sample. The matrix spike must be analyzed by the same procedures used to analyze the unspiked sample.

(4) The quality control (QC) must be conducted as required by the Methods 1622/1623. The quality control acceptance criteria are the same as the method requirements; the Initial Precision and Recovery (IPR) mean must be 24-100% and precision must be 55% (as maximum relative standard deviation). For Ongoing Precision and Recovery (OPR) samples required by Methods 1622 and 1623, recovery must be 11-100%.

(5) All samples for *Cryptosporidium* must be analyzed in a laboratory approved by EPA for such analyses.

(b) *E. coli* in source waters. You must use the methods listed in **Table #,** from *Guidelines Establishing Test Procedures for the Analysis of Pollutants; Analytical Methods for Biological Pollutants in Ambient Water*. [REPLACE WITH CFR CITE WHEN FINALIZED.] All samples for *E. coli* must be analyzed in a laboratory certified by EPA or the State for such analyses.

Methods for *E. coli* enumeration[1]

Technique	Method[1]	EPA	VCSB Methods			Commercial Example
			Standard Methods	ASTM	AOAC	
Most Probable Number (MPN)	LTB, EC-MUG		9221B.1/9221F			
	ONPG-MUG		9223B		991.15	Colilert®[2]
	ONPG-MUG		9223B			Colilert-18®[,2,4]
	CPRG-MUG		9223B			Colisure™[2]
Membrane Filter (MF)	mFC→NA-MUG		9222D/9222G			
	ENDO→NA-MUG		9222B/9222G			
	mTEC agar	1103.1	9213D	D5392 - 93		
	Modified mTEC agar	Modified 1103.1				
	MI agar	EPA-600-R-013				
	m-ColiBlue24 broth					m-ColiBlue24[3]

[1]Tests must be conducted in a format that provides organism enumeration.

[2]Manufactured by IDEXX.

[3]Manufactured by Hach Company.

[4]Acceptable version of method approved as a drinking water ATP.

(c) Turbidity. You must use methods for turbidity measurement approved in §141.74. Turbidity measurements must be made an individual approved by the State.

§141.1105 What assistance will EPA provide for the *Cryptosporidium* monitoring program?

[TO BE DETERMINED - NEED PHONE # FOR MESSAGES AND EMAIL ADDRESS]

§141.1106 What are the monitoring alternatives for filtered systems serving <10,000 people?

(a) You must conduct source water monitoring either of *E. coli* (or of an alternative indicator specified by the State) or of *Cryptosporidium.*

(b) You must begin one year of *E. coli* or other approved indicator source water monitoring every two weeks (for a total of 26

samples) no later than [30 months after rule publication].

(c) You must conduct *Cryptosporidium* monitoring indicated in §141.1101(d) if *E. coli* monitoring conducted under this section demonstrates an annual mean concentration >10/100 ml for lakes and reservoirs or >50/100 ml for flowing streams, or if approved alternative indicator monitoring conducted under this section demonstrates an annual mean concentration that exceeded State-approved trigger levels, or if you do not conduct *E. coli* or other approved indicator monitoring.

§141.1107 How can my system use previously collected data?

You may use *Cryptosporidium* data collected before [insert date of rule publication] if the data meet the conditions in paragraphs (a) through (h) and EPA notifies you no later than [insert date four months after publication] that the submitted data may be used towards bin determination in §141.1108. If EPA has not notified you that the submitted data are sufficient for bin determination in §141.1108, you must comply with the initial source water monitoring requirements in §§141.1101 through 141.1105.

(a) The data were generated by laboratories meeting minimum QA/QC criteria using Method 1622 or 1623 as described in the validated versions of these methods or modified, equivalent versions of these methods.

(b) The data have been collected in successive one year increments, with samples taken no less frequently than each calendar month on a regular schedule, beginning no earlier than January 1999.

(c) The data were collected in equal intervals of time over the entire collection period (e.g., daily, weekly, monthly).

(d) The data were representative of a plant's source water(s) and the source water(s) have not changed.

(e) You must submit all data collected during the sampling period.

(f) You have provided a letter to EPA [insert address], no later than [insert date six months following the LT2ESWTR proposal] stating your intent to submit the historical data to EPA for the purpose of complying with the LT2ESWTR monitoring requirements.

(g) You submit to EPA [insert address], no later than [insert date two months following publication], the set of data you intend to use for determining bin compliance and the basis for why these data should be accepted. The submission must include every element identified in paragraphs (g)(1) though (g)(4).

(1) The EPA Method 1622 or Method 1623 bench sheet and *Cryptosporidium* report form for each sample.

(2) A summary sheet that contains, for each sample, the necessary information in §§141.1102(e)(1) through 141.1102(e)(6).

(3) A general information sheet that includes PWS information, protozoa laboratory information, and identification of the type of

approval sought.

(4) A certification that all sample results collected during the sampling period have been included in the submission.

(h) The laboratory that generated the candidate data in paragraph (g) submits a letter to EPA [insert address] no later than [insert date two months following publication] certifying that the QA/QC criteria specified in Method 1622/1623 in §141.1104 have been met for the period of consideration.

§141.1108 What type of previously collected data may be used?

You may submit historical data for use in determining bin classification in §141.1108. EPA will classify the data as either Type A data or Type B data.

(a) Type A data are equivalent in QA/QC procedures to data collected under §141.1104. Type A data may be used by itself to estimate the plant's bin category or used in conjunction with data collected under §141.1104. If used in conjunction with data collected under §141.1104, the bin category may be based on more than two years of data.

(b) Type B data are equivalent in QA/QC procedures to data collected under §141.1104, except for a few conditions (e.g., a small percentage of the required QC samples is missing). If approved by EPA, these data may be used only for determining if you fall into bin 1 (<0.075 oocysts/L) in §141.1104, and the calculation for this bin determination must be based on the upper 95th percentile confidence bound of the estimate of the mean rather than the median estimate of the mean.

§141.1109 How does my system determine its bin classification based on initial source water monitoring analytical results?

(a) If you are a filtered system or an unfiltered system that is required to install filtration because you no longer meet all filtration avoidance criteria, you must first calculate your *Cryptosporidium* bin concentration. If you took a total of at least 48 samples during the required monitoring period, your *Cryptosporidium* bin concentration is equal to the mean of all sample concentrations. If you serve at least 10,000 people and took a total of at least 24 samples, but no more than 47 samples, during the required monitoring period, your *Cryptosporidium* bin concentration is equal to the highest average of all sample concentrations in any 12 consecutive months in the required monitoring period. If you serve fewer than 10,000 people and took at least 24 samples during the required monitoring period, your *Cryptosporidium* bin concentration is equal to the highest average of all sample concentrations in

any six consecutive months in the required monitoring period.

(b) If you are a filtered system or an unfiltered system that is required to install filtration because you no longer meet all filtration avoidance criteria, you determine your bin classification from the following table based on the monitoring in §§141.1100 through 141.1105 and the *Cryptosporidium* bin concentration calculation in paragraph (a).

Bin Classification Table for Filtered Systems

If you are:	**And your *Cryptosporidium* bin concentration (2) is ...(3)**	**Your bin classification is...**
...a system serving at least 10,000 people	*Cryptosporidium* <0.075/L	Bin 1
	0.075/L ≤ *Cryptosporidium* < 1.0/L	Bin 2
	1.0/L ≤ *Cryptosporidium* < 3.0/L	Bin 3
	Cryptosporidium ≥ 3.0/L	Bin 4
... a system serving fewer than 10,000 people and your average *E. coli* concentration is<10/100 ml for lake or reservoir sources or <50/100 ml for flowing stream sources	NA	Bin 1
... a system serving fewer than 10,000 people and your average *E. coli* concentration is ≥10/100 ml for lake or reservoir sources or ≥50/100 ml for flowing stream sources (1)	*Cryptosporidium* <0.075/L	Bin 1
	0.075/L ≤ *Cryptosporidium* < 1.0/L	Bin 2
	1.0/L ≤ *Cryptosporidium* < 3.0/L	Bin 3
	Cryptosporidium ≥ 3.0/L	Bin 4

(1) You must conduct one year of *Cryptosporidium* monitoring at a frequency specified in §141.1101.
(2) Based on calculations in paragraph (a).
(3) You may use existing data if you meet the criteria in §§141.1106 and 141.1107.

(c) If you are an unfiltered system that meets all filtration avoidance criteria, you must calculate your mean based on all samples collected under §141.1102. You must meet the requirements in §141.1121 based on that mean.

Disinfection Profiling and Benchmarking Requirements for *Giardia* and viruses

§141.1110 What are disinfection profiling and benchmarking requirements?

Under disinfection benchmark requirements, certain systems must develop an inactivation profile and benchmark for *Giardia* and viruses. The disinfection benchmark provisions contain three major components: applicability requirements and milestones,

characterization of disinfection practice, and State review of proposed changes in disinfection practice.

§141.1111 Do disinfection profiling and benchmarking requirements apply to my system?

(a) If you are required under this subpart to characterize *Cryptosporidium* occurrence in source water based on one or two years of *Cryptosporidium* monitoring results, you must conduct *Giardia* and virus inactivation profiling. If you serve fewer than 10,000 persons, you are only required to monitor for *Cryptosporidium* if you have exceeded certain source water *E. coli* levels. You may also be required to develop an inactivation benchmark depending on the level of DBPs in the distribution system.

(b) Both the *Cryptosporidium* monitoring requirement and the profiling and benchmarking requirement are waived if you have treatment in place that qualifies for 5.5 or more log of *Cryptosporidium* treatment credit, equivalent to compliance with Bin 4 in §141.1120.

(c) If you serve fewer than 10,000 people and do not have at least 5.5 log of *Cryptosporidium* treatment, equivalent to compliance with Bin 4 in §141.1120, already in place, and you conduct compliance monitoring for TTHM and HAA5 in more than one location, you are required to meet the *Giardia* and virus inactivation profiling requirement if either TTHM levels in the distribution system based on the samples collected for compliance with subpart L are at least 0.056 mg/L as an annual average or HAA5 levels in the distribution system based on the samples collected for compliance with subpart L are at least 0.042 mg/L as an annual average. You must base your DBP annual averages on one year's TTHM and HAA5 compliance data collected under subpart L after [insert date of publication], or as determined by the State.

(d) If you serve fewer than 10,000 people and do not have at least 5.5 log of *Cryptosporidium* treatment, equivalent to compliance with Bin 4 in §141.1120, already in place, and you conduct compliance monitoring for TTHM and HAA5 in only one location, you are required to meet the *Giardia* and virus inactivation profiling requirement if either TTHM levels in the distribution system based on the samples collected for compliance with subpart L are at least 0.064 mg/L as an annual average or HAA5 levels in the distribution system based on the samples collected for compliance with subpart L are at least 0.048 mg/L as an annual average. You must base your DBP annual averages on one year's TTHM and HAA5 compliance data collected under subpart L after [insert date of publication], or as determined by the State.

(e) You may use existing operational data to develop a profile and benchmark if those data meet the criteria in §141.1113(c).

(f) You may use the profile developed under §141.172 or §§141.530 through 141.536 if that profile meets the criteria in §141.1113(c). If you have not developed a virus profile under §141.172 or §§141.530 through 141.536, you must use the same monitoring data that you used to develop the *Giardia lamblia* profile to develop the virus profile.

§141.1112 What is the schedule for disinfection profiling and benchmarking requirements?

(a) You must comply with the schedule in the table in this paragraph.

Schedule of required inactivation benchmarking milestones (1)

Activity	Date for completion of activity		
	Subpart H systems serving at least 10,000 people	Subpart H systems serving <10,000 people	
		Required to monitor for *Cryptosporidium*	Requirement based on DBP levels
Submit report to State on TTHM and HAA5 annual averages	NA	NA	[42 months following publication]
Begin inactivation profiling	[24 months following publication]	[54 months following publication]	[42 months following publication]
Complete inactivation profiling based on at least one year's data	[36 months following publication]	[66 months following publication]	[54 months following publication]

(1) Systems with greater than 5.5 logs of *Cryptosporidium* treatment already in place are not required to monitor for *Cryptosporidium* or to do inactivation profiling.
(2) This requirement is waived if the State has waived the requirement based on its approval of grandfathered data and inactivation benchmark as described in §§141.1111(e) and 141.1113(c).

(b) If you serve fewer than 10,000 people, you must begin inactivation profiling by the date in paragraph (a) if you are required to monitor for *Cryptosporidium* or your TTHM or HAA5 running annual averages exceed the levels specified in §§141.1111(c) or 141.1111(d). In addition, you must report to the State your TTHM and HAA5 annual averages and whether the profiling requirements apply by the date indicated in paragraph (a).

(c) This profiling requirement may be waived if your request for approval of existing data under §141.1113(c) is approved in writing by the State prior to the date that you would be required to begin profiling. If the State does not approve the request or does not respond, you must begin inactivation profiling by the date indicated in paragraph (a).

§141.1113 How do I develop a profile?

(a) You must monitor at least weekly on the same day of the week for a period of 12 consecutive calendar months to determine the total log inactivation for *Giardia lamblia* and viruses for that day of operation. You must determine log inactivation for *Giardia lamblia* based on the CT99.9 values in Tables 1.1-1.6, 2.1, and 3.1 of §141.74(b), as appropriate, through the entire treatment plant. You must determine log inactivation for viruses, based on a protocol approved by the State, through the entire treatment plant.

(b) You must begin this monitoring not later than the date specified in §141.1112(a). As a minimum, if you have a single point of disinfectant application prior to entrance to the distribution system, you must conduct the monitoring in paragraph (c). If you have more than one point of disinfectant application, you must conduct the monitoring in paragraph (c) for each disinfection segment. You must monitor the parameters necessary to determine the total inactivation ratio, using analytical methods in §141.74(a).

(c) You must monitor for the following parameters.

(1) The temperature of the disinfected water must be measured at each residual disinfectant concentration sampling point during peak hourly flow.

(2) If you use chlorine, the pH of the disinfected water must be measured at each chlorine residual disinfectant concentration sampling point during peak hourly flow.

(3) The disinfectant contact time(s) (“T”) must be determined during peak hourly flow.

(4) The residual disinfectant concentration(s) (``C'') of the water before or at the first customer and prior to each additional point of disinfection must be measured during peak hourly flow.

(d) In lieu of the monitoring conducted under the provisions of paragraph (c) to develop the disinfection profile, you may elect to meet the requirements of this paragraph (d).

(1) If you have one year (12 consecutive months) of existing operational data, or if you have one year (12 consecutive months) of operational data collected under either §141.172 or §§141.530 through 141.536, and you have not made a significant change to your treatment and disinfection practices and you have not changed sources since those data were collected, you may submit those data, a profile of both *Giardia lamblia* and virus inactivation generated using those data, and a request that the State approve use of those data in lieu of monitoring under the provisions of paragraph (c).

(2) The State must determine whether these operational data are substantially equivalent to data collected under the provisions of paragraph (c). These data must be representative of *Giardia lamblia* and virus inactivation through the entire treatment plant and not just of certain treatment segments.

(3) Until the State approves this request, you are required to conduct monitoring under the provisions of paragraph (c) based on the schedule in §141.1112.

(e) You must calculate the total inactivation ratio as follows:

(1) If you use only one point of disinfectant application, you may determine the total inactivation ratio for the disinfection segment based on either of the methods in paragraph (e)(1)(i) or (e)(1)(ii).

(i) Determine one inactivation ratio ($CTcalc/CT_{99.9}$) before or at the first customer during peak hourly flow.

(ii) Determine successive $CTcalc/CT_{99.9}$ values, representing sequential inactivation ratios, between the point of disinfectant application and a point before or at the first customer during peak hourly flow. Under this alternative, the system must calculate the total inactivation ratio by determining ($CTcalc/CT_{99.9}$) for each sequence and then adding the ($CTcalc/CT_{99.9}$) values together to determine (Σ ($CTcalc/CT_{99.9}$)).

(2) If you use more than one point of disinfectant application before the first customer, you must determine the CT value of each disinfection segment immediately prior to the next point of disinfectant application, or for the final segment, before or at the first customer, during peak hourly flow. The (CTcalc/CT99.9) value of each segment and (Σ ($CTcalc/CT_{99.9}$)) must be calculated using the method in paragraph (e)(1)(i).

(3) The system must determine the total logs of inactivation by multiplying the value calculated in paragraph (b)(4)(i) or (ii) of this section by 3.0.

(4) You must calculate the log of inactivation for viruses using a method approved by the State.

(5) You must retain disinfection profile data in graphic form, as a spreadsheet, or in some other format acceptable to the State for review as part of sanitary surveys conducted by the State.

141.1114 How do I calculate a benchmark?

(a) If you are required to develop a disinfection profile under the provisions of this subpart and you decide to make a significant change to its disinfection practice, you must consult with the State prior to making such change. Significant changes to disinfection practice are:

(1) Changes to the point of disinfection;

(2) Changes to the disinfectant(s) used in the treatment plant;

(3) Changes to the disinfection process; and

(4) Any other modification identified by the State.

(b) If you intend to modify your disinfection practice, you must calculate your disinfection benchmark using the procedure specified in paragraph (b)(1) through (b)(4).

(1) For each year of profiling data collected and calculated under §141.1113, you must determine the lowest average monthly *Giardia lamblia* and virus inactivation in each year of profiling data. You must determine the average *Giardia lamblia* and virus inactivation for each calendar month for each year of profiling data by dividing the sum of daily or weekly *Giardia lamblia* and virus log inactivation by the number of values calculated for that month.

(2) The disinfection benchmark is the lowest monthly average value (for systems with one year of profiling data) or average of lowest monthly average values (for systems with more than one year of profiling data) of the monthly logs of *Giardia lamblia* and virus log inactivation in each year of profiling data.

141.1115 How do I consult with the State prior to making a significant change in disinfection?

You must submit information in paragraphs (a) through (c) to the State as part of your consultation process.

(a) A description of the proposed change.

(b) The disinfection profile and benchmark for *Giardia lamblia* and viruses under §§141.1113 and 141.1114.

(c) An analysis of how the proposed change will affect the current levels of disinfection.

Treatment Technique Requirements

§141.1120 What are treatment requirements for filtered systems?

You are required to provide a level of treatment for *Cryptosporidium* that is based on your bin classification and existing treatment type, as specified in the table in this section. If you currently use toolbox options specified in §141.1122 in addition to the specified filtration treatments, you may receive credit for those technologies towards bin requirements.

If your bin classification is...	**And you use the following filtration treatment in full compliance with subpart H, P, and Q (as applicable), then your additional treatment requirements are...**			
	Conventional filtration treatment (includes softening)	**Direct filtration**	**Slow sand or diatomaceous earth filtration**	**Alternative filtration technologies**
Bin 1	No additional treatment	No additional treatment	No additional treatment	No additional treatment
Bin 2	1 log treatment (1)	1.5 log treatment	1 log treatment	(3)
Bin 3	2 log treatment (2)	2.5 log treatment	2 log treatment	(4)
Bin 4	2.5 log treatment (2).	3 log treatment	2.5 log treatment	(5)

(1) systems may use any technology or combination of technologies from §141.1122.
(2) systems must achieve at least 1 log of the required 2/2.5 log treatment using ozone, chlorine dioxide, UV, membranes, bag/cartridge filters, or in-bank filtration.
(3) as determined by the State such that the total *Cryptosporidium* removal and inactivation are at least 4.0 logs.
(4) as determined by the State such that the total *Cryptosporidium* removal and inactivation are at least 5.0 logs.
(5) as determined by the State such that the total *Cryptosporidium* removal and inactivation are at least 5.5 logs.

§141.1121 What are treatment requirements for unfiltered systems?

(a) You must continue to comply with all of the avoidance criteria requirements in §§141.71, 141.171, and 141.521, as well as the requirements of §141.1122.

(b) You must provide 2-log *Cryptosporidium* inactivation if your *Cryptosporidium* occurrence mean is $\leq$1 oocyst/100L.

(c) You must provide 3-log *Cryptosporidium* inactivation if your *Cryptosporidium* occurrence mean is >1 oocyst/100L.

(d) You must comply with the requirements for TTHM and HAA5 in subpart XXX.

(e) You must meet the overall inactivation requirements using a minimum of two disinfectants.

§141.1122 How must my system meet its specified treatment level?

(a) In order to meet the log treatment requirements identified for each "Action Bin", or to achieve total treatment requirements in the case of unfiltered systems, you may use one or more options from the *Cryptosporidium* control strategies in the table in paragraph (b).

(b) You may select one or a combination of the following "microbial toolbox" treatment options to meet your treatment technique requirements. Options listed in the table, when designed and implemented in accordance with the requirements of this subpart, receive the specified log credit (or range of credit). You may receive credit greater than that specified on a case-by-case basis if the State determines that the option can reliably achieve such a credit on a continuing basis and the State provides you with written approval of greater credit, including any additional monitoring or performance requirements the State determines are necessary to demonstrate the greater credit.

Microbial toolbox: options, log credits, and design/implementation criteria

Toolbox Option	Proposed *Cryptosporidium* log credit with design and implementation criteria
Watershed Control Program	0.5 log credit for State approved program comprising EPA specified elements; Potential for additional credit based on *Cryptosporidium* reduction demonstrated through monitoring. Specific criteria are in §141.1125(j).
Alternative source/ Intake management	No presumptive credit. Systems may be assigned to a lower bin based on *Cryptosporidium* monitoring at new intake location. Re-binning would occur after system begins using new intake location. Specific criteria are in §141.1125(k).
Off-stream raw water storage (1)	0.5 log credit for reservoir with hydraulic residence time (HRT) of at least 21 days; 1.0 log credit for reservoir with HRT of at least 60 days. Specific criteria are in §141.1125(l).
Pre-sedimentation basin with coagulation (1)	0.5 log credit with continuous operation and coagulant addition. Specific criteria are in §141.1125(m).
Lime softening	0.5 log credit for second stage softening w/coagulant. Specific criteria are in §141.1125(g).
Bank filtration (1)	0.5 log credit for 25 ft. setback; 1.0 log credit for 50 ft. setback. Specific criteria are in §141.1125(n).
Lower finished water turbidity	0.5 log credit for combined filter effluent turbidity ≤ 0.15 NTU in 95% of samples each month. 1.0 log credit for individual filter effluent turbidity ≤ 0.15 NTU in 95% of samples each month. Specific criteria are in §141.1125(b).
Slow sand filters	2.5 log credit as add-on technology. Specific criteria are in §141.1125(c).
Second stage filtration	0.5 log credit for second separate filtration stage in treatment process. Specific criteria are in §141.1125(f).
Membranes (MF, UF, NF, RO)	Log credit equivalent to removal efficiency demonstrated in challenge test for device if supported by direct integrity testing. Specific criteria are in §141.1125(d).
Bag filters	1 log credit with demonstration of at least 2 log removal efficiency in challenge test; State may award greater credit. Specific criteria are in §141.1125(e).
Cartridge filters	2 log credit with demonstration of at least 3 log removal efficiency in challenge test; State may award greater credit. Specific criteria are in §141.1125(e).
Chlorine dioxide	Log credit based on demonstration of compliance with CT table or alternative values approved by the State. Specific criteria are in §141.1125(h).
Ozone	Log credit based on demonstration of compliance with CT table or alternative values approved by the State. Specific criteria are in §141.1125(i).
UV	Log credit based on demonstration of compliance with UV dose table or alternative values approved by the State. Specific criteria are in §141.1125(a).
Demonstration of Performance	1.0 log credit if average spore removal ≥ 4 log based on one year of weekly monitoring. Specific criteria are in §141.1125(o).

(1) Credit available only if source water *Cryptosporidium* monitoring was conducted prior to option.

§141.1123 When does my system have to comply with the treatment requirements?

You must comply with the requirement for installation and operation of the *Cryptosporidium* control treatment technology by meeting the schedule in §141.1101.

§141.1124 What must my system do to comply with requirements for uncovered finished water reservoirs?

You must meet one of the criteria in paragraphs (a) through (c) not later than the date specified in §141.1101.

(a) You must cover any existing uncovered finished water reservoirs.

(b) You must treat the discharge from the reservoir to the distribution system to achieve a 4-log virus inactivation.

(c) You must develop a risk mitigation plan which addresses physical access, surface water runoff, animal and bird waste, and ongoing water quality assessment and have that plan approved by the State. You must implement the risk mitigation plan approved by the State.

§141.1125 How does my system demonstrate compliance?

(a) Ultraviolet Light

(1) You may claim credit for ultraviolet (UV) processes for disinfection of *Cryptosporidium*, *Giardia*, and viruses. The disinfection credit you can receive for each target pathogen is based on the delivered UV dose provided in relation to the UV dose tables in paragraph (a)(4).

(2) To receive UV disinfection credit, you must demonstrate a delivered UV dose based on the results of a reactor validation test and ongoing monitoring. The reactor validation test determines the operating conditions under which a UV reactor can achieve a delivered UV dose. Monitoring is required to demonstrate that you maintain validated operating conditions during routine use. The State may designate a different demonstration of performance.

(3) UV dose is defined as the product of the UV intensity and the exposure time. Delivered UV dose is defined as a dose assigned to a reactor based on the degree of inactivation of a microorganism achieved during a bioassay challenge test or by an alternative test approved by the State. The delivered dose is determined by comparing the reactor validation test result with a known dose-response relationship for the test microorganism.

(4) The values given in the UV dose table are for UV light at a wavelength of 254 nm as delivered by a low pressure mercury vapor

lamp. The dose tables can be applied to UV reactors with other lamp types through demonstration of a delivered dose (i.e. performance demonstration). These dose values are for post-filter application of UV in surface water systems and for unfiltered systems meeting filtration avoidance criteria in subparts H, P, and T.

UV dose table for *Cryptosporidium*, *Giardia*, and virus inactivation credit

Log credit	*Cryptosporidium* UV dose (mJ/cm^2)	*Giardia* UV dose (mJ/cm^2)	Virus UV dose (mJ/cm^2)
0.5	TBD	TBD	TBD
1.0	TBD	TBD	TBD
1.5	TBD	TBD	TBD
2.0	TBD	TBD	TBD
2.5	TBD	TBD	TBD
3.0	TBD	TBD	TBD
3.5	NA	NA	TBD
4.0	NA	NA	TBD

(5) Reactor validation testing. To receive disinfection credit for a UV reactor, you must demonstrate to the State that the reactor can achieve the required UV dose through the validation protocol in Appendix A to this subpart, unless the State approves an alternative approach.

(6) Reactor monitoring. You must monitor for parameters necessary to demonstrate compliance with the operating conditions that were validated for the required UV dose. At a minimum, you must monitor for irradiance, flow rate, and lamp outage. You must regularly calibrate UV sensors.

(7) Compliance determination for unfiltered systems.

(i) If you are required to achieve 2-log inactivation of *Cryptosporidium* through the use of UV light, you must comply with this requirement by demonstrating that at least 99.0% of the water that entered the distribution system (based on volume) during the calendar month was treated to the required level.

(iii) If you are required to achieve 3-log inactivation of *Cryptosporidium* through the use of UV light, you must comply with this requirement by demonstrating that at least 99.90% of the water that entered the distribution system (based on volume) during the calendar month was treated to the required level.

(iii) You must install filtration no later than 36 months after the end of a quarter in which a second monthly violation in the most recent four quarters occurs.

(b) Finished water turbidity.

(1) If you use conventional filtration treatment or direct filtration, you may claim a 0.5 log credit towards *Cryptosporidium* treatment requirements for any month at each plant that demonstrates that combined filter effluent (CFE) turbidity levels are less than or equal to 0.15 NTU in at least 95 percent of the measurements taken each month, based on sample measurements conducted under §§141.SWTR/IESWTR/LT1. You may not claim the credit if you monitor less frequently than every four hours.

(2) If you use conventional filtration treatment or direct filtration, you may claim an additional 1.0 log removal credit towards *Cryptosporidium* treatment requirements at any plant that demonstrates that turbidity levels in each individual filter effluent are less than or equal to 0.15 NTU in at least 95 percent of the measurements taken each month. Compliance with this criterion would be determined based on the total number of measurements of each individual filter effluent at 15 minute intervals. All individual filters must meet this criterion in a particular month for credit to be granted.

(3) You may not claim credit under both paragraphs (b)(1) and (b)(2) in the same month.

(c) Slow sand. You may claim a 2.5 log credit for slow sand filtration that follows an existing filtration process if all the flow is treated and a disinfectant residual is not present in the influent water to the slow sand filtration.

(d) Membranes.

(1) If you operate a membrane process, you may apply to the State for a removal credit for *Cryptosporidium* of 2.5 log (or greater if verification testing demonstrates greater removal) by submitting the results of testing under Appendix B of this subpart.

(2) You must conduct direct integrity monitoring in a manner that demonstrates continued removal performance. Direct integrity monitoring is defined as a test applied directly to the membrane system to detect leaks in the membrane, seals, potting material, or other wetted components. Direct integrity tests are usually applied to a group of membrane modules that share common valving, referred to as a membrane unit. The method used for direct integrity monitoring must meet the following performance criteria:

(i) The direct integrity method must be capable of directly testing the physical integrity of the entire membrane unit including membranes, seals, potting material, associated valving and piping, and all other components that could contaminate the filtrate if they were to fail.

(ii) The direct integrity method must be applied in a manner such that leakage through a 3 μm hole contributes to the overall

response from the integity test.

(iii) The direct integrity test must be sensitive enough to reliably produce a measureable response from the smallest integrity breach that would compromise the ability of the membrane unit to meet the removal credit awarded by the State. The relationship between the sensitivity of a direct integrity test, expressed as the flow through the smallest integrity breach that can be detected, and the maximum log removal value that can be verified by the direct integrity test is defined by the following equation:

$$LR_{Max} = LOG[Q_{Filtrate}/CF \times Q_{Breach}]$$

where LR_{Max} = maximum log removal that can be verified by a direct integrity test; $Q_{Filtrate}$ = total design filtrate flow from the membrane unit; Q_{breach} = flow from the smallest breach that can be detected by the integrity test; and CF = the concentration factor. The concentration factor is a measure of the increase in concentration of the contaminant that could occur on the high pressure side of the membrane relative to the raw water.

(iv) A performance standard (control limit) must be established for the direct integrity test which is indicative of an integral membrane unit capable of meeting the removal credit awarded by the State. This control limit can be established through physical demonstration, theoretical calculations supported by empirical data, or an alternative method approved by the State.

(v) If a direct integrity test result is outside the control limit, the integrity test must be repeated to confirm the result. If the second result is also outside the control limit, then the membrane unit must be isolated, and diagnostic testing must be conducted to isolate the integrity breach. Once the problem has been corrected, another direct integrity test must be conducted to verify the repair, and following a successful integrity test the membrane unit can be returned to service.

(vi) Direct integrity testing must be conducted on each membrane unit at a frequency of not less than once every 24 hours while the plant is in operation.

(vii) Any filtration system that cannot be direct integrity tested according to the criteria specified in this subpart does not meet the definition of a membrane in §141.2.

(3) Continuous indirect integrity monitoring. In addition to periodic direct integrity testing, you must conduct continuous monitoring on each membrane unit according to the criteria in paragraphs (d)(3)(i) through (iv).

(i) Continuous monitoring must be conducted using turbidity meters, defined as readings every 15 minutes.

(ii) Continuous monitoring must be independently conducted on each membrane unit. Multiplexing of monitoring equipment can be used to reduce the number of monitoring units required.

(iii) The filtrate turbidity must be no higher than 0.10 NTU in at least 95% of individual samples taken each month.

(iv) Two consecutive 15 minute readings above 0.15 NTU trigger direct integrity testing and subsequent diagnostic testing.

(e) Bag and cartridge filters. You may request one-log *Cryptosporidium* treatment credit for bag filters and a two-log *Cryptosporidium* treatment credit for cartridge filtration devices from the State by demonstrating that the criteria in Appendix C of this subpart are met.

(f) Second stage filtration. (1) You may claim an additional 0.5 log *Cryptosporidium* removal credit if you have a separate second stage filtration consisting of rapid sand, dual media, GAC, or other fine grain media in a separate stage following rapid sand or dual media filtration. To be eligible for this credit, the first stage of filtration must be preceded by a coagulation step and both filtration stages must treat 100% of the flow.

(2) A cap, such as GAC, on a single stage of filtration does not qualify for this credit.

(g) Two stage lime softening. You may claim a 0.5 log *Cryptosporidium* credit if you operate a two-stage softening plant and have a second clarification step between the primary clarifier and filter which is operated continuously and which treats all of the plant flow. In addition, a coagulant must be present in the second stage clarifiers (including precipitation of magnesium hydroxide).

(h) Chlorine dioxide.

(1) Calculation of CT values. CT is a product of the disinfectant contact time (T, in minutes) and disinfectant concentration (C, in milligrams per liter). You must calculate CT every day, with both C andf T measured during peak hourly flow.

(i) "T" is the time water takes to move from the point where the initial disinfectant residual concentration is measured to the point where the final disinfectant residual concentration is measured in a specified disinfectant segment.

(ii) "C" is the geometric mean of the initial disinfectant residual concentration (C_o) and the final disinfectant residual concentration (C_f) in a specified disinfection segment ($C = (C_o * C_f)^{½}$). If the initial disinfectant residual concentration is not measured, C equals C_f.

(iii) If you have several disinfection segments (the segment is defined as a treatment unit process with a measurable disinfectant residual level and a liquid volume) in sequence along the treatment train, you may calculate the CT for each disinfection segment and use the sum of the log inactivation estimates of *Cryptosporidium* achieved through the plant.

(2) CT values for chlorine dioxide.

(i) You must use the table in this paragraph if you measure both initial and final ozone residuals and use the geometric mean CT for estimating log inactivation.

CT values for *Cryptosporidium* inactivation by chlorine dioxide as function of water temperatures based on geometric mean of "C" across a disinfection segment

Logs	Water Temperature, °C								
	1	2	3	5	7	10	15	20	25
0.5	335	307	282	237	200	154	100	65	42
1.0	670	614	564	474	399	308	200	130	85
1.5	1004	922	846	712	599	462	301	195	127
2.0	1339	1229	1127	949	799	617	401	260	169
2.5	1674	1536	1409	1186	998	771	501	326	212
3.0	2009	1843	1691	1423	1198	925	601	391	254

(ii) You must use the table in this paragraph if you measure only the final chlorine dioxide residual level and use only C_f for calculating CT.

Table IV.19: CT values for *Cryptosporidium* inactivation by chlorine dioxide as function of water temperatures for systems only measuring final chlorine dioxide residual at a disinfection segment

Logs	Water Temperature, °C								
	1	2	3	5	7	10	15	20	25
0.5	252	231	212	179	150	116	75	49	32
1.0	504	462	424	357	301	232	151	98	64
1.5	756	694	636	536	451	348	226	147	96
2.0	1008	925	849	714	601	464	302	196	127
2.5	1260	1156	1061	893	751	580	377	245	159
3.0	1512	1387	1273	1071	902	696	452	294	191

(iii) You may conduct a site-specific inactivation study at the plant to determine the CT values necessary to meet a specified log inactivation level, using a State-approved protocol for a site-specific study. If you choose to use a site-specific study as the basis for developing CT values to estimate *Cryptosporidium* inactivation, you must use the 90% upper confidence limit for deriving CT values. The alternative CT values determined from the site-specific study and the method of calculation must be approved by the State.

(c) Compliance determination for unfiltered systems.

(i) You are in violation of the treatment technique if you use chlorine dioxide and if, on more than one day in the calendar month,

you fail to achieve the required log inactivation.

(ii) You must install filtration no later than 36 months after the end of a quarter in which a second monthly violation in the most recent four quarters occurs.

(i) Ozone.

(1) Calculation of CT values. CT is a product of the disinfectant contact time (T, in minutes) and disinfectant concentration (C, in milligrams per liter). You must calculate CT every day, with both C andf T measured during peak hourly flow.

(i) "T" is the time water takes to move from the point where the initial disinfectant residual concentration is measured to the point where the final disinfectant residual concentration is measured in a specified disinfectant segment (i.e., an ozone chamber).

(ii) "C" is the geometric mean of the initial disinfectant residual concentration (C_o) and the final disinfectant residual concentration (C_f) in a specified disinfection segment ($C = (C_o * C_f)^{½}$). If the initial disinfectant residual concentration is not measured, C equals C_f.

(iii) If you have several disinfection segments (the segment is defined as a treatment unit process with a measurable disinfectant residual level and a liquid volume) in sequence along the treatment train, you may calculate the CT for each disinfection segment and use the sum of the log inactivation estimates of *Cryptosporidium* achieved through the plant.

(2) CT values for Ozone.

(i) You must use the table in this paragraph if you measure both initial and final ozone residuals and use the geometric mean CT for estimating log inactivation.

CT Values as Function of Water Temperatures for Systems Based on Geometric Mean of "C" at Contact Chamber

Logs	Water Temperature, °C								
	1	2	3	5	7	10	15	20	25
0.5	18.5	12.1	9.4	6.9	5.6	4.5	3.5	2.9	2.6
1.0	37.0	24.2	18.9	13.8	11.2	9.0	7.0	5.9	5.1
1.5	55.5	36.3	28.3	20.7	16.8	13.5	10.6	8.8	7.7
2.0	74.0	48.4	37.7	27.6	22.4	18.0	14.1	11.8	10.3
2.5	92.5	60.5	47.2	34.5	28.1	22.5	17.6	14.7	12.9
3.0	111.0	72.6	56.6	41.4	33.7	27.1	21.1	17.7	15.4

(ii) You may use the table in this paragraph if you only measure the final ozone residual level and only use C_t for calculating CT.

CT Values as Function of Water Temperatures for Systems only Measuring Final Ozone Residual at Contact Chamber

Logs	Water Temperature, °C								
	1	2	3	5	7	10	15	20	25
0.5	13.1	8.6	6.7	4.9	4.0	3.2	2.5	2.1	1.8
1.0	26.2	17.2	13.4	9.8	8.0	6.4	5.0	4.2	3.6
1.5	39.3	25.7	20.1	14.7	11.9	9.6	7.5	6.3	5.5
2.0	52.5	34.3	26.8	19.6	15.9	12.8	10.0	8.4	7.3
2.5	65.6	42.9	33.4	24.4	19.9	16.0	12.5	10.5	9.1
3.0	78.7	51.5	40.1	29.3	23.9	19.2	15.0	12.5	10.9

(iii) You may conduct a site-specific inactivation study at the plant to determine the CT values necessary to meet a specified log inactivation level, using a State-approved protocol for a site-specific study. If you choose to use a site-specific study as the basis for developing CT values to estimate *Cryptosporidium* inactivation, you must use the 90% upper confidence limit for deriving CT values. The alternative CT values determined from the site-specific study and the method of calculation must be approved by the State.

(c) Compliance determination for unfiltered systems.

(i) You are in violation of the treatment technique if you use ozone and if, on more than one day in the calendar month, you fail to achieve the required log inactivation.

(ii) You must install filtration no later than 36 months after the end of a quarter in which a second monthly violation in the most recent four quarters occurs.

(j) Watershed control program. If you intend to qualify for a 0.5 log *Cryptosporidium* reduction credit for a watershed control program, you must notify the State within one year following initial bin assignment that you intend to develop a watershed control program and to submit it for State approval.

(1) You must submit a proposed watershed control plan and a request for plan approval and 0.5 log *Cryptosporidium* removal credit to the State not later than 2 years after the State has made a decision on bin assignment. The State will review your initial proposed watershed control plan and approve, reject, or conditionally approve the plan. If the plan is approved, or if you agree to implement the State's conditions for approval, you are awarded 0.5 log *Crytposporidium* removal credit to apply against additional treatment requirements.

(2) The application to the State for initial program approval must include elements in paragraphs (j)(2)(i) through (iii).

(i) An analysis of your source water vulnerability to the different sources of *Cryptosporidium* identified in the watershed. The vulnerability assessment must include a characterization of the watershed hydrology and identification of an "area of influence on source water quality" (the area to be considered in future watershed surveys). The assessment must also address sources of *Cryptosporidium*, seasonal variability, and the relative impact of the sources of *Cryptosporidium* on the system's source water quality.

(ii) An analysis of sustainable interventions and an evaluation of their relative effectiveness in reducing *Cryptosporidium* in source water.

(iii) A plan that addresses goals and defines and prioritizes specific actions to reduce source water *Cryptosporidium* levels. The plan must explain how the actions are expected to contribute to specific goals, identify partners and their role(s), resource requirements and commitments, and include a schedule for plan implementation.

(3) Initial State approval and subsequent approvals of your watershed control plan and its associated 0.5 log *Cryptosporidium* removal credit are valid for three years. You are responsible for taking the actions in paragraphs (j)(3)(i) through (iii) to maintain State approval and the 0.5 log credit.

(i) Submit an annual watershed control program status report to the State during the last three months of each year of the approval period, or by a date determined by the State. The annual watershed control program status report must describe your implementation of the approved plan and assess the adequacy of the plan to meet its goals. It must explain how you are addressing any shortcomings in plan implementation, including those previously identified by the State or as the result of the watershed survey. If it became necessary during implementation to make substantial changes in your approved watershed control program, you must explain the reason for such changes. If any change is likely to reduce the level of source water protection, you must explain what actions you will take to mitigate the effects.

(ii) Conduct a State-approved watershed survey at a minimum frequency of once every three years and submit the survey report to the State. The survey must be conducted according to State guidelines and by persons approved by the State to conduct watershed surveys. The survey must cover the area of the watershed that was identified in the State-approved watershed control plan as the area of influence and focus mainly on assessing the priority activities identified in the plan and on identifying any significant new sources of *Cryptosporidium.*

(iii) Submit to the State a request for review and re-approval of the watershed control program and for a continuation of the 0.5 log removal credit for a subsequent approval period. The request should be provided to the State at least six months before the three-year approval period expires or by a date previously determined by the State. The request must include a summary of activities and issues identified during the approval period and a revised plan that addresses activities for the next approval period including details of any proposed changes from the existing State-approved program. The plan must address goals, priorities of specific actions to reduce source water *Cryptosporidium*, explain how actions are expected to contribute to achieving goals, identify partners and their role(s), resource requirements and commitments, and the schedule for plan implementation.

(k) Alternative source. (1) You may be assigned to a different bin by changing the intake location (either within the same source or to an alternate source) and/or managing timing or level of withdrawal, if you conduct monitoring which demonstrates a different *Cryptosporidium* concentration to be used for bin assignment.

(2) You must conduct a second round of monitoring to demonstrate the efficacy of the proposed intake management strategy. Sampling and analysis of *Cryptosporidium* in the second round of monitoring must conform to the requirements that applied to the system in the initial monitoring conducted under this subpart to determine bin classification, except that systems originally required to monitor twice per month for one year may instead monitor monthly for two years.

(3) Following completion of the second round of monitoring, you must determine a second *Cryptosporidium* average. Calculation of the second average must conform to the requirements that applied to the system for the initial monitoring, except that all systems that monitor monthly for two years must calculate the average as a maximum 12-month running annual average. You must meet the treatment requirements associated with the intake management strategy that you choose.

(4) If the State assigns you to a lower bin based on implementing a new intake management strategy, you must continue this strategy in routine operation.

(l) Offstream storage. You may request log credit towards *Cryptosporidium* treatment requirements for off-stream storage reservoirs which meet criteria in paragraphs (l)(1) and either (l)(2) or (l)(3). Off-stream storage reservoirs are basins located between a water source (typically a river) and the coagulation and filtration processes in a treatment plant. If you monitor an existing off-stream storage reservoir for the purpose of determining bin assignment under §141.1108, you may not claim this credit.

(1) The off-stream storage reservoir must be continuously operated and all the water which enters the treatment plant must pass through the off-stream storage reservoir. You must maintain hydraulic control of the reservoir inlet and all reservoir outlets and meet

any requirements that the State requires to demonstrate adequate hydraulic control and control of contamination caused by surface water runoff.

(2) Off-stream storage reservoirs which are operated with a mean hydraulic residence time of at least 21 days are eligible for *Cryptosporidium* credit of 0.5 log.

(3) Off-stream storage reservoirs which are operated with a mean hydraulic residence time of at least 60 days are eligible for *Cryptosporidium* credit of 1.0 log.

(m) Pre-sedimentation. You may claim 0.5 log credit towards *Cryptosporidium* treatment requirements for pre-sedimentation which meets criteria in paragraphs (m)(1) through (m)(4). If you monitor after an existing pre-sedimentation basin for the purpose of determining bin assignment under §141.1108, you may not claim this credit.

(1) The presedimentation unit must be in continuous operation and treat all of the flow reaching the treatment plant.

(2) You must add a coagulant.

(3) You may not exceed a maximum day settling surface loading rate of 1.6 gpm/ft^2 at any time.

(4) Your source water turbidity must have an annual average at least 10 NTU or maximum at least 100 NTU.

(n) Bank filtration. You may request that the State grant either a 0.5 or a 1.0 log credit for *Cryptosporidium* removal by bank filtration by demonstrating that bank filtration meets criteria specified in the protocol in Appendix D of this subpart. If you monitor after existing bank filtration for the purpose of determining bin assignment under §141.1108, you may not claim this credit. You may also monitor using the provisions of paragraph (k) to demonstrate an alternate source.

(o) Demonstration of performance. You may claim a 1-log credit towards additional *Cryptosporidium* treatment requirements if you demonstrate, through monitoring, an annual mean removal of at least 4-log of aerobic spore-forming bacteria (or other parameter approved by the State) across the treatment plant.

(1) You must conduct at least weekly paired sampling of the plant influent and combined filter effluent for a period of at least one year. You may sample more frequently if sampling is evenly distributed.

(2) Mean log removal must be calculated using the annual average of all effluent samples divided by the annual average of all influent samples. If you do not measure any spores (or alternative parameter) in the effluent, the effluent concentration must be set equal to the method detection limit.

(3) If you achieve the 1-log credit through demonstration of performance as described in this paragraph (o), you are not eligible to

receive credit for lower finished water turbidity in paragraph (b) or for existing pretreatment processes (*e.g*. off-stream storage, pre-sedimentation) located after the influent sampling point.

§141.1126 What are the requirements for use of an approved laboratory?

(a) *Cryptosporidium* You must have *Cryptosporidium* samples analyzed by a laboratory which has passed a quality assurance evaluation under EPA's Laboratory Quality Assurance Evaluation Program for Analysis of *Cryptosporidium* in Water described in **FRN [TBD]** or a laboratory which has been certified for *Cryptosporidium* analysis by a State laboratory certification program.

(b) *E. coli*. (1) Any laboratory certified for total coliforms, fecal coliforms, or *E. coli* analysis in source water under subpart H by the State, NELAC or EPA is deemed certified for *E. coli* analysis under this subpart, provided the same method is used.

(2) Any laboratory certified by the State, NELAC or EPA for total coliform or fecal coliform in source water is deemed certified for *E. coli* under this subpart when the laboratory uses the same technique for *E. coli*, uses the method for source water in §141.74, and uses an analyst approved by the State to measure *E. coli* in source water.

(c) Turbidity. Measurements of turbidity must be conducted by a party approved by the State.

Reporting and Recordkeeping Requirements

§141.1130 What does subpart Ω require that my system report to the State?

(a) You must report to the State in accordance with the tables in this paragraph if you intend to use or do use any toolbox option.

Toolbox reporting requirements

Toolbox Option (Potential *Cryptosporidium* reduction log credit)	You must submit the following items	On the following schedule if you serve ≥10,000 people [1]	On the following schedule if you serve <10,000 people [1]
Watershed Control Program (WCP) (0.5 log)	Notify State of intention to develop WCP	No later than [prom. + 48 months]	No later than [prom. + 78 months]
	Submit initial WCP plan to State	No later than [prom. + 60 months]	No later than [prom. + 90 months]
	Have State-approved WCP	No later than [72 months after prom.].	No later than [102 months after prom.].
	Annual report	Every 12 months, beginning on [prom. + 84 months].	Every 12 months, beginning on [prom. + 114 months].
	State approved watershed survey report	No less than every 3 years beginning on [prom + 108 months].	No less than every 3 years beginning on [prom + 138 months].
	3 year request for renewal of WCP	No later than every 36 months, beginning on [prom. + 102 months].	No later than every 36 months, beginning on [prom. + 132 months].
Alternative Source (Bin reclassification)	Results of second round of *Cryptosporidium* monitoring for alternative source (*e.g.*, different intake site) to determine bin reclassification	Monthly reporting for 24 months to be completed no later than [prom. + 72 months].	Monthly reporting for 24 months to be completed no later than [prom. + 102 months].
Off-stream raw water storage (0.5 or 1.0 log)	Demonstration of: • Continuous reservoir operation • Treatment of 100% of the flow reaching the treatment plant • Hydraulic residence times of at least 21 days (0.5 log) or 60 days (1.0) log • Hydraulic control • Control of contamination	No later than [72 months after prom.].	No later than [102 months after prom.].

Toolbox Option (Potential *Cryptosporidium* reduction log credit)	You must submit the following items	On the following schedule if you serve ≥10,000 people [1]	On the following schedule if you serve <10,000 people [1]
Pre-sedimentation (0.5 log)	Demonstration of: • Continuous basin operation • Treatment of 100% of the flow reaching the main treatment plant • Addition of a coagulant • Maximum day settling surface loading rate of 1.6 gpm/ft^2 • Source water turbidity with average at least 10 NTU or maximum at least 100 NTU	No later than [72 months after prom.].	No later than [102 months after prom.].
Two-Stage Lime Softening (0.5 log)	Demonstration of: • Continuous operation of a second clarification step between the primary clarifier and filter which treats 100% of the plant flow; • Presence of coagulant in second stage clarifiers	No later than [72 months after prom.].	No later than [102 months after prom.].
Bank filtration (0.5 or 1.0 log or bin reclassification)	Initial demonstration of: • Unconsolidated, predominantly sandy aquifer • Setback distance of at least 25 ft. (0.5 log) or 50 ft. (1.0 log) Monthly demonstration that avg. of daily max turbidity ≤ 1.0 NTU in well effluent	Initial demonstration no later than [72 months after prom.] Monthly reporting of turbidity within 10 days following the month in which the monitoring was conducted, beginning on [prom. +72 months].	Initial demonstration no later than [102 months after prom.] Monthly reporting of turbidity within 10 days following the month in which the monitoring was conducted, beginning on [prom. + 102 months].
	Results of second round of *Cryptosporidium* monitoring in well effluent to determine bin reclassification	Monthly reporting for 24 months to be completed no later than [prom. + 72 months].	Monthly reporting for 24 months to be completed no later than [prom. + 102 months].

Toolbox Option (Potential *Cryptosporidium* reduction log credit)	You must submit the following items	On the following schedule if you serve ≥10,000 people [1]	On the following schedule if you serve <10,000 people [1]
Lower finished water turbidity (0.5 or 1.0 log)	Monthly demonstrations of: • Combined filter effluent (CFE) turbidity levels less than or equal to 0.15 NTU in at least 95 percent of the 4 hour CFE measurements taken each month (0.5 log) • Individual filter effluent (IFE) turbidity levels less than or equal to 0.15 NTU in at least 95 percent of the 15 minute IFE measurements taken each month (1.0 log)	Monthly Demonstration: within 10 days following the month in which the monitoring was conducted, beginning on [prom. +72 months].	Monthly Demonstration: within 10 days following the month in which the monitoring was conducted, beginning on [prom. + 102 months].
Membranes (MF, UF, NF, RO) (2.5 log or greater based on verification/integrity testing)	Results of verification testing demonstrating: • Removal efficiency through challenge studies • Methods of challenge studies meet rule criteria • Integrity test results and baseline	No later than [72 months after prom.].	No later than [102 months after prom.].
	Results of periodic direct integrity monitoring at least once every 24 hours demonstrating: • Method of integrity test meets rule criteria • Summary of all excursions above the control limit	Within 10 days following the month in which monitoring was conducted, beginning [prom. + 72 months].	Within 10 days following the month in which monitoring was conducted, beginning [prom. + 102 months].
	Monthly demonstration of 95th percentile of effluent turbidity values for each membrane unit below 0.10 NTU Summary of all excursions above 0.15 NTU	Within 10 days following the month in which monitoring was conducted, beginning [prom. + 72 months].	Within 10 days following the month in which monitoring was conducted, beginning [prom. + 102 months].

Toolbox Option (Potential *Cryptosporidium* reduction log credit)	You must submit the following items	On the following schedule if you serve ≥10,000 people [1]	On the following schedule if you serve <10,000 people [1]
Bag filters (1.0 log) and Cartridge filters (2.0 log)	Demonstration that the following criteria are met: • Process meets the basic definition of bag or cartridge filtration; • Removal efficiency established through challenge testing that meets rule criteria • Challenge test shows at least 2 and 3 log removal for bag and cartridge filters, respectively	No later than [72 months after prom.].	No later than [102 months after prom.].
Chlorine dioxide (log credit based on CT)	Daily CT based on Tables in §141.xxx.	Within 10 days following the month in which monitoring was conducted, beginning [prom. + 72 months].	Within 10 days following the month in which monitoring was conducted, beginning [prom. + 102 months].
Ozone (log credit based on CT)	Daily CT based on Tables in §141.xxx.	Within 10 days following the month in which monitoring was conducted, beginning [prom. + 72 months].	Within 10 days following the month in which monitoring was conducted, beginning [prom. + 102 months].
UV (Based UV dose and operation within validated conditions)	Demonstration of a delivered UV dose based on: (1) Results of a reactor validation test to determine operating conditions necessary to achieve UV dose; and (2) Summary of all periods when UV reactors operated outside of validated conditions for the required UV dose	(1) No later than [72 months after prom.], and (2) Within 10 days following the month in which monitoring was conducted, beginning [prom +72 months].	(1) No later than [102 months after prom.], and (2) Within 10 days following the month in which monitoring was conducted, beginning [prom +102 months].

Toolbox Option (Potential *Cryptosporidium* reduction log credit)	You must submit the following items	On the following schedule if you serve ≥10,000 people [1]	On the following schedule if you serve <10,000 people [1]
Demonstration of Performance (1 log credit)	Results of 1 year of weekly paired influent and CFE monitoring to demonstrate: ▸ an annual mean removal of at least 4-log (99.99%) of aerobic spore forming bacteria; OR ▸ other parameter approved by the State.	No later than [prom. + 72 months].	No later than [prom. + 102 months].

[1] Compliance dates listed as "beginning on" X date refer to the date when the first occurrence of the action must be completed.

(b) You must report the information associated with disinfection profiling and benchmarking in accordance with the tables in this paragraph.

Disinfection profile and benchmark reporting requirements for systems serving ≥10,000 people

System Type	Benchmark Component	Submit the following items	On the following schedule
Systems Required to Conduct *Cryptosporidium* Monitoring	Applicability	Justification for systems seeking approval of existing inactivation profile	Must receive approval no later than [prom + 24 months] or conduct profiling
	Characterization of Disinfection Practices	*Giardia* and virus inactivation profiling results	No later than [prom + 36 months]
	State Review of Proposed Changes to Disinfection Practices	Inactivation benchmark determinations	Prior to significant modification of disinfection practice
Systems Not Required to Conduct *Cryptosporidium* Monitoring [1]	Applicability	None	None
	Characterization of Disinfection Practices	None	None
	State Review of Proposed Changes to Disinfection Practices	None	None

[1] Systems that provide at least 5.5 log of *Cryptosporidium* treatment consistent with a Bin 4 treatment implication are not required to conduct *Cryptosporidium* monitoring.

Disinfection profile and benchmark reporting requirements for systems serving <10,000 people

System Type	Benchmark Component	Submit the following items	On the following schedule
Systems Required to Conduct *Cryptosporidium* Monitoring	Applicability Period	Justification for systems seeking approval of existing inactivation profile	Must receive approval no later than [prom + 54 months] or conduct profiling
	Characterization of Disinfection Practices	*Giardia* and virus inactivation profiling results	No later than [prom + 66 months]
	State Review of Proposed Changes to Disinfection Practices	Inactivation benchmark determinations	Prior to significant modification of disinfection practice
Systems with low mean *E. Coli* concentration that exceed DBP triggers[2,3]	Applicability Period	Justification for systems seeking approval of existing inactivation profile	Must receive approval no later than [prom + 42 months] or conduct profiling
		Submit TTHM/HAA5 data to State	No later than [prom. + 42 months]
	Characterization of Disinfection Practices	*Giardia* and virus inactivation profiling results	No later than [prom + 54 months]
	State Review of Proposed Changes to Disinfection Practices	Inactivation benchmark determinations	Prior to significant modification of disinfection practice
Systems with low mean *E. Coli* concentration that does not exceed DBP triggers[2,3]	Applicability Period	Submit TTHM/HAA5 data to State	No later than [prom. + 42 months]
	Characterization of Disinfection Practices	None	None
	State Review of Proposed Changes to Disinfection Practices	None	None
Systems Not Required to Conduct *Cryptosporidium* Monitoring based on advanced treatment in place[1]	None	None	None

[1] Systems that provide at least 5.5 log of *Cryptosporidium* treatment consistent with a Bin 4 treatment implication are not required to conduct *Cryptosporidium* monitoring.

[2] If the E.coli annual mean concentration is ≤ 10/100 mL for systems using lakes/reservoirs or ≤ 50/100 mL for systems using flowing streams, the systems is not

required to conduct *Cryptosporidium* monitoring and would only be triggered into a characterization of disinfection practices if DBP triggers are exceeded.
[3] If system is a CWS or NTNCWSs and TTHM or HAA5 levels in the distribution system exceed levels in §§141.1111(c) or 141.1111(d), system is triggered into characterization of disinfection practices.

§141.1131 What records does subpart Ω require my system to keep?

Your system must keep several types of records based on the requirements of subpart Ω, in addition to recordkeeping requirements under §§141.75 and 141.175 [ADD LT1 REFERENCE ALSO.]. Your system must keep monitoring and bin characterization results until 36 months after any new source water monitoring has been completed. Bin characterization results must be available for review during any reassessment and sanitary surveys.

APPENDICES TO SUBPART Ω

APPENDIX A - UV APPROVAL

- To receive disinfection credit for a UV reactor, you must demonstrate that the reactor can deliver the required UV dose. Unless the State approves an alternative approach, this demonstration is required to involve the following:

(1) Full scale testing of a reactor which conforms uniformly to the UV reactors used by the system,

(2) Inactivation of a test microorganism whose dose response characteristics have been quantified with a low pressure mercury vapor lamp.

- Testing must determine a set of operating conditions which can be monitored by the system to ensure that the required UV dose is delivered in routine operation. At a minimum, these operating conditions must include flow rate, UV irradiance as measured by a UV sensor, and UV lamp status. The validated operating conditions determined by testing must account for the following: UV absorbance of the water, lamp fouling, lamp ageing,UV sensor accuracy, the residence time distribution of water within the reactor, failure of UV lamps or other critical system components, and inlet and outlet piping or channel configurations of the UV reactor.

APPENDIX B - MEMBRANE APPROVAL

Challenge testing

You must conduct a challenge test to evaluate the removal efficiency of the membrane process. The removal efficiency demonstrated during challenge testing establishes the maximum removal credit that a membrane process is eligible to receive, provided this value is less than or equal to the maximum log removal value that can be verified by the direct integrity test described in §141.1125(a)(2). Challenge testing is required for specific products and is not intended to be site-specific. The State may accept data from challenge studies conducted prior to [insert date of publication] in lieu of additional testing. However, the prior testing must have been conducted in a manner that demonstrates a removal efficiency for *Cryptosporidium* commensurate with the treatment credit awarded to the process. Unless the State approves an alternative approach, challenge testing must be conducted according to the following criteria:

(1) Challenge testing must be conducted on a full-scale membrane module identical in material and construction to the membrane modules that will be used in the full-scale treatment facility. Alternatively, challenge testing may be conducted on a smaller membrane

module if the removal efficiency and integrity test results for the smaller module are directly scalable to full-scale module performance.

(2) Challenge testing must be conducted using *Cryptosporidium* oocysts or a surrogate which has been shown through testing to be removed no more efficiently than *Cryptosporidium* oocysts. The organism or surrogate used during challenge testing is referred to as the challenge particulate. It must be discretely quantifiable with a detection limit equal to one organism or surrogate per unit of volume analyzed.

(3) The feed water concentration of the challenge particulate may not exceed a value six orders of magnitude greater than the detection limit of the challenge particulate. This allows the demonstration of up to 6 log removal if the challenge particulate is removed to the detection limit.

(4) Challenge testing must be conducted using the maximum design flux and system recovery specified by the manufacturer.

(5) Removal efficiency of a membrane process, expressed as log removal, is determined from the results of the challenge test, as defined by the following equation:

$$\text{Log Removal} = LOG_{10}(\text{Feed Concentration}) - LOG_{10}(\text{Filtrate Concentration})$$

The feed and filtrate concentrations must be expressed in the same units (number of organisms or surrogates per unit volume). If the challenge particulate is not detected in the filtrate, then the term "LOG_{10}(Filtrate Concentration)" is set equal to zero.

(6) If fewer than twenty individual log removal data points are generated during a challenge study, the lowest log removal observed is the removal efficiency assigned to the process. If twenty or more individual log removal data points are generated during challenge testing, the removal efficiency for the process is set equal to the 10^{th} percentile. The percentile is defined by [i/(n+1)] where i is the rank of n individual data points ordered lowest to highest. It may be necessary to calculate the 10^{th} percentile using linear interpolation.

(7) The challenge test must establish standards for a nondestructive performance test (*e.g*. bubble point test, pressure decay test, forward air flow test) that is indicative of the removal efficiency of the membrane module. The performance test must be applied to each production membrane module that did not undergo a challenge test in order to verify removal efficiency.

(8) Any significant modification to the membrane barrier or module configuration (*e.g*., change to the polymer chemistry of the membrane, changes to seals or potting in the module design) requires additional challenge testing to demonstrate removal efficiency of the modified module.

APPENDIX C - BAG AND CARTRIDGE FILTER APPROVAL

Challenge testing

In order to receive 1-log removal credit, a bag filter must have a demonstrated removal efficiency of 2 log or greater for *Cryptosporidium.* Similarly, to receive 2-log removal credit, a cartridge filter must have a demonstrated removal efficiency of 3 log or greater for *Cryptosporidium.* A 1-log factor of safety is applied to the removal credit awarded to these filtration devices because they cannot be direct integrity tested; hence, there is no means of verifying the removal efficiency of units during routine use.

Removal efficiency must be demonstrated through a challenge study conducted on the bag or cartridge filter proposed for use in full-scale drinking water treatment facilities for removal of *Cryptosporidium.* Challenge testing is required for specific products and is not intended to be site-specific. The State may accept data from challenge studies conducted prior to [insert date of publication] in lieu of additional testing if the prior testing was consistent with the criteria specified in this appendix. Unless the State approves an alternative approach, challenge testing must be conducted according to the following criteria.

(1) Challenge testing must be conducted on a full-scale filter element identical in material and construction to the filter elements proposed for use in full-scale treatment facilities.

(2) Challenge testing must be conducted using *Cryptosporidium* oocysts or a surrogate which is removed no more efficiently than *Cryptosporidium* oocysts. The organism or surrogate used during challenge testing is referred to as the challenge particulate. It must be discretely quantifiable with a detection limit equal to one organism or surrogate per unit of volume analyzed.

(3) The feed water concentration of the challenge particulate must not exceed a value four orders of magnitude greater than the detection limit of the challenge particulate.

(4) Challenge testing must be conducted at the maximum design flow rate specified by the manufacturer.

(5) Each filter must be tested for a duration sufficient to reach 100% of the *terminal pressure drop*, a parameter specified by the manufacturer which establishes the end of the useful life of the filter.

(6) Each filter must be challenged with the challenge particulate during three periods over the filtration cycle: within 2 hours of start-up after a new bag or cartridge filter has been installed, when the pressure drop is between 45 and 55% of the terminal pressure drop, and at the end of the run after the pressure drop has reached 100% of the terminal pressure drop.

(7) Challenge testing must demonstrate a removal efficiency of 2 log or greater for bag filtration and 3 log or greater for cartridge filtration, where log removal is calculated by the following equation:

$$\text{Log Removal} = LOG_{10}(\text{Feed Concentration}) - LOG_{10}(\text{Filtrate Concentration})$$

The feed and filtrate concentrations must be expressed in the same units (number of organisms or surrogates per unit volume). If the challenge particulate is not detected in the filtrate, then the term "LOG_{10}(Filtrate Concentration)" is set equal to zero.

(8) If fewer than twenty individual log removal data points were generated during a challenge study, the lowest log removal observed is the removal efficiency assigned to the process. If twenty or more individual log removal data points were generated during challenge testing, the removal efficiency for the process is set equal to the 10^{th} percentile. The percentile is defined by [i/(n+1)] where i is the rank of n individual data points ordered lowest to highest. It may be necessary to calculate the 10^{th} percentile using linear interpolation.

(9) Any significant modification to the filtration unit (*e.g*., changes to the filtration media, changes to the configuration of the filtration media, significant modifications to the sealing system) requires additional challenge testing to demonstrate removal efficiency of the modified unit.

APPENDIX D - BANK FILTRATION APPROVAL

To be eligible for credit, bank filtration wells must be drilled in an unconsolidated, predominantly sandy aquifer, as determined by sieve analysis. Wells located at least 25 feet from the surface water source are eligible for 0.5 log credit; wells located at least 50 feet from the source are eligible for 1.0 log credit. Systems must continuously monitor turbidity in wells to assure that no system failure is occurring. If the monthly average of daily maximum turbidity values exceeds 1 NTU, the system must report this finding to the State. The system must conduct an assessment to determine the cause of the high turbidity levels in the well and consult with the State regarding whether previously allowed credit is still appropriate. States may grant additional *Cryptosporidium* treatment credit to systems using bank filtration which meets the design criteria specified in this appendix.

Systems with bank filtration may also monitor for *Cryptosporidium* in the well effluent for the purpose of being reclassified to a lower bin. This option may be employed by systems which have installed bank filtration that does not conform to the design criteria specified above for credit. *Cryptosporidium* monitoring may also be used by systems which meet the design criteria for 0.5 or 1.0 log credit, but which require a greater level of additional treatment as a result of their initial bin classification. The additional *Cryptosporidium* monitoring must conform to the sample frequency, sample volume, analytical method, and other requirements

which applied to the system for the initial *Cryptosporidium* monitoring. The system must submit the results of the new monitoring to the State, along with a description of the bank filtration system. The State will determine whether the system should be reclassified into a lower bin. If reclassified into a different bin as a result of the additional monitoring, the system must then meet any additional treatment requirements associated with the new bin assignment. Systems which monitor the well effluent to determine bin classification receive no credit towards additional treatment requirements for the bank filtration.

Conducting additional monitoring for the purpose of being reclassified to a lower bin does not modify compliance time frames for the LT2ESWTR. Systems which conduct additional monitoring following installation of a bank filtration system generally must comply with the treatment requirements of the new bin assignment (if reclassified) or of the original bin assignment (if not reclassified) within three years (plus two years if granted by the State) of the initial bin assignment.

The following provides more detail on the aquifer types and ground water collection devices that are eligible for bank filtration credit.

What aquifer types are eligible for bank filtration credit?

Only granular aquifers are eligible for bank filtration credit. Granular aquifers are those comprised of sand, clay, silt, rock fragments, pebbles or larger particles, and minor cement. The aquifer material must be unconsolidated, with subsurface samples friable upon touch. Granular aquifers are of relatively recent origin. Those granular aquifers formed by alluvial or glacial processes are eligible for bank filtration credit. Such aquifers are typically identified on a detailed geologic map as being of glacial origin or simply labeled as Quaternary alluvium.

A system seeking *Cryptosporidium* removal credit must characterize the aquifer at the well site to determine aquifer properties. At a minimum, the aquifer characterization must include the collection of relatively undisturbed continuous core samples from the surface to a depth at least equal to the bottom of the well screen. Each recovered core interval must be examined to determine if at least ten percent of the grains in that interval are less than 1.5 mm in diameter. Each length of core with at least ten percent of the grains less than 1.5 mm in diameter must be noted as an interval with sufficient fine-grained material so as to provide adequate removal. An aquifer is eligible for removal credit if at least 85% of the cored intervals contain sufficient fine-grained material as defined above.

Wells located in consolidated aquifers, fractured bedrock, karst limestone, and gravel aquifers are not eligible for bank filtration credit.

Granular aquifers, either unconsolidated or partially consolidated, and formed earlier than the Pleistocene geologic period (the most recent period of glaciation) must be considered by the State on a case-by-case basis to determine if they are too cemented, and therefore too fractured, to provide sufficient natural filtration.

What groundwater collection devices are eligible for bank filtration credit?

A number of devices are used for the collection of ground water, including spring boxes, infiltration galleries, and horizontal and vertical wells. Among these, only horizontal and vertical wells are eligible for log removal credit. The following describes characteristics of these devices which serve as a basis for this requirement.

A spring box is located at the ground surface and is designed to contain spring outflow and protect it from surface contamination until the water is utilized. Spring boxes are typically located where natural processes have enhanced and focused ground water discharge into a smaller area and at a faster volumetric flow rate than elsewhere (i.e. a spring). Often, localized fracturing or solution enhanced channels are the cause of the focused discharge to the spring orifice. Since fractures and solution channels have significant potential to transport microbial contaminants, spring boxes are not eligible for bank filtration credit.

An infiltration gallery (or filter crib) is typically a slotted pipe installed horizontally into a trench and backfilled with granular material. The gallery is designed to collect water infiltrating from the surface or to intercept ground water flowing naturally toward the surface water. In some treatment plants, surface water is transported to a point above an infiltration gallery and then allowed to infiltrate. The infiltration rate may be manipulated by varying the properties of the backfill or the nature of the soil-water interface. Because the filtration properties of the material overlying an infiltration gallery may be designed or purposefully altered to optimize oocyst removal, this engineered system is not bank filtration, which relies solely on the natural properties of the system. However, an infiltration gallery may be eligible for *Cryptosporidium* removal credit as an alternative treatment technology [40 CFR 141.73(d)].

Horizontal wells are designed to capture large volumes of surface water recharge. They typically are constructed by the excavation of a central vertical caisson with laterals that extend horizontally from the caisson bottom in all directions. Horizontal wells are usually shallower than vertical wells because of the construction expense.

A vertical or horizontal well located adjacent to a surface water body is eligible for bank filtration credit if there is sufficient groundwater flow path length to effectively remove oocysts. The groundwater flow path to a vertical well is the measured distance from the edge of the surface water body, under high flow conditions (determined by the mapped extent of the floodway, as defined in Federal Emergency Management Agency flood hazard maps), to the well intake. The groundwater flow path to a horizontal well is the

measured distance from the bed of the river under normal flow conditions to the closest horizontal well lateral.

Some wells, especially horizontal wells, may be not be constructed so that the well is truly horizontal or truly vertical. In these instances, there may be some uncertainty about the actual, as constructed, separation distance from surface water. To provide additional assurance that the assigned removal credit is being realized, continuous turbidity monitoring is required for all wells that receive credit. Monthly average turbidity levels (based on daily maximum values) that exceed 1.0 NTU trigger a site investigation by the system to determine if microbial removal has been compromised.

Wells are often located on islands and peninsulas because they provide a favorable setting for high water yields, but may be compromised by surface contamination threats. If the island is small in diameter or narrow, or the peninsula is narrow, then there is an increased likelihood that the groundwater flow path length is short. A well located on an island or peninsula can potentially capture surface water from several compass directions. In contrast, a well not located on an island or peninsula will typically capture surface water only from the side which faces the surface water body that serves as the primary source. On the opposite side, the well will capture native ground water. Thus, wells that capture mostly infiltrating surface water undiluted by native ground water, such as wells on a small island or narrow peninsula, have greater potential for higher surface water contamination because less dilution by native ground water occurs, and are not eligible for credit.

PART 142 - NATIONAL PRIMARY DRINKING WATER REGULATIONS IMPLEMENTATION

1. The authority citation for part 142 continues to read as follows:

Authority:

2. Section 142.14 is proposed to be amended by adding paragraph (a)(9) to read as follows:

§142.14 Records kept by States.

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(a) ***

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(9) Any decisions made pursuant to the provisions of part 141, subpart Ω of this chapter.

(i) Bin determinations for each system (including results of initial and reassesment source water monitoring).

(ii) The toolbox treatment technologies that a system employs to meet their treatment technique requirements in addition to any changes in toolbox treatment technologies.

(iii) Any reclassification of a system's bin characterization based on Reassessment Monitoring and resulting technology changes.

(iv) Any other changes to initial bin classifications based on sanitary survey review.

(v) A record of the technologies employed by unfiltered systems to meet virus, *Giardia* and *Cryptosporidium* inactivation requirements.

(vi) A list of systems required to cover or treat effluent of an uncovered finished water reservoir.

(vii) A list of systems for which the State has waived the requirement to treat or cover reservoirs and supporting documentation.

14. Section 142.15 is proposed to be amended by adding paragraph (c)(6) to read as follows:

§142.15 Reports by States.

(c) ***

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(6) *Subpart* Ω. (i) Initial bin classification for each system and any changes in bin classifications.

(ii) The technologies that a filtered system employs to meet their action bin requirements (including any changes in toolbox treatment technologies) and the disinfectants employed by unfiltered systems to meet inactivation requirements.

15. Section 142.16 is proposed to be amended by adding paragraph (l) to read as follows:

§142.16 Special primacy conditions.

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(l) *Requirements for States to adopt 40 CFR part 141, subpart* Ω. In addition to the general primacy requirements elsewhere in this part, including the requirements that State regulations be at least as stringent as federal requirements, an application for approval of a State program revision that adopts 40 CFR part 141, subpart Ω, must contain a description of how the State will accomplish the following program requirements.

(1) As part of the sanitary survey process, the State will assess significant changes in the watershed and source water and how the State will determine, with systems, appropriate follow-up action.

(2) Determine if toolbox options are properly implemented.

(3) Determine that a system with an uncovered finished water reservoir has an existing risk mitigation plan that is adequate for purposes of waiving the requirement to cover or treat the reservoir.